

CONSERVATION PRACTICE STANDARD

DIVERSION (Ft.) CODE 362

DEFINITION

A channel constructed across the slope generally with a supporting ridge on the lower side.

PURPOSES

This practice may be applied as part of a resource management system to support one or more of the following purposes.

- Break up concentrations of water on long slopes, on undulating land surfaces, and on land that is generally considered too flat or irregular for terracing.
- Water must be diverted as part of a pollution abatement system.
- Divert water away from farmsteads, agricultural waste systems, and other improvements.
- Increase or decrease the drainage area above ponds.
- Protect terrace systems by diverting water from the top terrace where topography, land use, or land ownership prevents terracing the land above.
- Intercept surface and shallow subsurface flow.
- Reduce runoff damages from upland runoff.
- Reduce erosion and runoff on urban or developing areas and at construction or mining sites.
- Divert water away from active gullies or critically eroding areas.
- Supplement water management on conservation cropping or stripcropping systems.

CONDITIONS WHERE PRACTICE APPLIES

This applies to all cropland and other land uses where surface runoff water control and or management is needed. It also applies where soils and topography are such that the diversion can be constructed and a suitable outlet is available or can be provided.

CRITERIA

Capacity. Diversions as temporary measures, with an expected life span of less than 2 years, shall have a minimum capacity for the peak discharge from the 2-year frequency, 24-hour duration storm.

Diversions that protect agricultural land and those that are part of a pollution abatement system shall have a minimum capacity for the peak discharge from a 10-year frequency, 24 -hour duration storm.

Diversions designed to protect areas such as urban areas, buildings, roads, and animal waste management systems shall have a minimum capacity for the peak discharge from a storm frequency consistent with the hazard involved but not less than a 25-year frequency, 24-hour duration storm. Freeboard shall be not less than 0.3 ft. (See Figure 12 in TP-61 for proper hydraulic proportioning with freeboard.)

Diversions installed on reclaimed mined land may be either temporary or permanent. Temporary diversions are those used to divert streams and overland flow during mining and reclamation operations. They are not to remain after reclamation as part of the post-mining land use. Permanent diversions are those which remain after mining and reclamation operations. Diversions collecting runoff from disturbed lands must outlet into facilities for removal of sediment.

The diversion shall be design for capacity using the appropriate retardance from NRCS Engineering Field Handbook (EFH) Part 650, Table 9-1 and Exhibit 7-2.

Design depth is the channel storm flow depth plus freeboard, where required.

Cross section. The channel may be parabolic, V-shaped, or trapezoidal. The diversion shall be designed to have stable side slopes. The minimum cross section shall meet or exceed the design dimensions for the entire length of the diversion.

The ridge shall have a minimum top width of 4 feet at the design depth. The ridge height shall include an adequate settlement factor of at least 10 percent.

The top of the constructed ridge shall not be lower at any point than the design depth plus the specified overfill for settlement.

The design depth at culvert crossings shall be the culvert headwater depth for the design storm plus freeboard.

Grade and velocity. Channel grades may be uniform or variable. Channel velocity shall not exceed that considered non-erosive for the soil and planned vegetation or lining.

Channel velocities shall meet the requirements of NRCS Engineering Field Handbook (EFH) Part 650, Table 9-1 for the minimum anticipated retardance (bare earth if applicable).

Location. The location of the diversion shall be determined by outlet conditions, topography, land use, cultural operations, cultural resources, soil type, and length of slope.

A diversion in a crop field must be aligned and spaced from other structures or practices to permit the use of the operator's farming equipment.

Protection against sedimentation. Diversions normally should not be used below high sediment producing areas. When they are, a practice or combination of practices needed to prevent damaging accumulations of sediment in the channel shall be installed. This may include practices such as land treatment erosion control practices, cultural or tillage practices, vegetated filter strip, or structural measures. Install practices in conjunction with or before the diversion construction.

If movement of sediment into the channel is a problem, the design shall include extra capacity for sediment or periodic removal as outlined in the operation and maintenance plan.

Outlets. Each diversion must have a safe and stable outlet with adequate capacity. The outlet may be a grassed waterway, a lined waterway, a level spreader above a vegetated or paved area, a grade stabilization structure, an underground outlet, a stable watercourse, a sediment basin, or a combination of these practices. The outlet must convey runoff to a point where outflow will not cause damage. Vegetative outlets shall be installed and established before diversion construction to insure establishment of vegetative cover in the outlet channel.

When a level spreader is used, the length shall be one foot per CFS based the 10-year discharge with a minimum length of 5 feet and a maximum length of 30 feet. The entrance channel shall not exceed 1% grade for a minimum of 20 feet before entering level spreader. The outlet must convey runoff to a point where outflow will not cause damage.

The release rate of an underground outlet, when combined with storage, shall be such that the design storm runoff will not overtop the diversion ridge. On large watersheds, runoff flows are usually too large to outlet entirely through underground outlets. Underground outlets shall meet the requirements of Standard 620.

The design depth of the water surface in the diversion shall not be lower than the design elevation of the water surface in the outlet at their junction when both are operating at design flow.

Vegetation. Disturbed areas that will not be used for crop production shall be seeded as soon as practicable after construction.

Seedbed preparation, seeding, fertilizing, and mulching shall comply with Standard 342, Critical Area Planting, or the current Penn State publication "Erosion Control and Conservation Planting on Noncropland."

Lining. If the soils or climatic conditions preclude the use of vegetation for erosion protection, non-vegetative linings such as gravel, rock riprap, cellular block, or other approved manufactured lining systems may be used.

CONSIDERATIONS

At non-cropland sites, consider planting native vegetation in areas disturbed due to construction.

Maximize wetland functions and values with the diversion design. Minimize adverse effects to existing functions and values. Diversion of upland water to prevent entry into a wetland could convert a wetland by changing the hydrology. Construction activities should minimize disturbance to wildlife habitat. Opportunities should be explored to restore and improve wildlife habitat, including habitat for threatened, endangered, and other species of concern.

On landforms where archeological sites are likely to occur, use techniques to maximize identification of such sites prior to planning, design, and construction.

PLANS AND SPECIFICATIONS

Plans and specification for installing diversions shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be prepared for use by the client. The plan shall include specific instructions for maintaining diversion stability and capacity.

The minimum requirements to be addressed in the operation and maintenance plan are:

1. Provide periodic inspections, especially immediately following significant storms.
2. Promptly repair or replace damaged components of the diversion as necessary.
3. Maintain diversion capacity, ridge height, and outlet elevations especially if high sediment yielding areas are in the drainage area above the diversion. Establish necessary clean-out requirements.
4. Each inlet for underground outlets must be kept clean and sediment buildup redistributed so that the inlet is at the lowest point. Inlets damaged by farm machinery must be replaced or repaired immediately.
5. Redistribute sediment as necessary to maintain the capacity of the diversion.
6. Vegetation shall be maintained and trees and brush controlled by hand, chemical and/or mechanical means.
7. Keep machinery away from steep sloped ridges. Keep equipment operators informed of all potential hazards.

REFERENCES

1. NRCS Engineering Field Handbook (EFH) Part 650, Chapters 7 and 9.
2. SCS-TP-61, Handbook of Channel Design for Soil and Water Conservation.
3. Penn State "Erosion Control and Conservation Planting on Noncropland."

DIVERSION CONSTRUCTION SPECIFICATION

1. SCOPE

The work shall consist of constructing diversions at locations and to the dimensions shown on the drawings or as stated in Section 7 of this specification.

2. MATERIAL

a. Earth Fill

The earth material used in constructing the earth fill portions of the diversion shall be obtained from the diversion area, or other approved sources.

b. Pipe

Type of pipe, pipe sizes, fittings and other necessary pipe material shall be as specified on the drawings or in Section 7 of this specification, when applicable.

c. Other required materials shall be as shown in the drawings or in Section 7 of this specification.

3. FOUNDATION PREPARATION

The base area of the ridge sections shall be stripped of vegetation, topsoil, and unsuitable material and scarified prior to placing fill. Topsoil shall be stockpiled and spread uniformly over the finished diversion ridge and channel, unless stated otherwise in the drawings or in Section 7 of this specification

4. PIPE

Where specified, pipe shall be installed before earth placement unless otherwise stated on the drawings. The pipe shall be placed on a firm foundation with compacted backfill placed in horizontal lifts not exceeding 4 inches, to the lines and grades shown on the drawings.

5. PLACEMENT

Earth fill shall contain no frozen material, rocks greater than 6 inches in diameter, roots or wood greater than 2 inches in diameter or 4 inches in length, sod, brush, or other objectionable material.

The earth fill shall be compacted by routing the hauling and spreading equipment over the fill in such a manner that the entire surface of the fill will be traversed by not less than one track tread of the loaded equipment. The completed diversion shall conform to the cross section shown on the drawings, and be free of irregularities that would impede flow.

When an excess of earth material results from cutting the diversion to the cross section and grade, it shall be deposited adjacent to the diversion or another designated area where fill is needed.

6. LEVEL SPREADER

Where specified, a level spreader shall be constructed on zero percent grade to insure uniform spreading of sediment-free runoff (converting channel flow to sheet flow). Level spreaders shall be constructed on undisturbed soil (not on fill).

A geotextile erosion stop shall be placed vertically and at least six inches deep in a slit trench one foot back of the level lip and parallel with the lip. This erosion stop shall extend the entire length of the level lip and after backfilling with tamped soil the geotextile shall be trimmed so that the upper edge is flush with the soil surface. The entire level lip area shall be protected by placing two overlapping strips of jute or excelsior protective material.

Storm runoff converted to sheet flow shall outlet onto stabilized areas. Water shall not be concentrated immediately below the point of discharge.

7. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

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DESIGN AND CHECK DATA REQUIREMENTS

The following items must be documented for the diversion:

Basic Data

1. Plan view of system layout
2. Slope of each design reach
3. Total length
4. Type and location of outlet

Design

1. PA Utility Act compliance
2. Peak discharge calculation
3. Soil, vegetation, lining
4. Velocities, dimensions
5. Lining or mulching requirements
6. Lime, fertilizer, seeding requirements
1. Operation & maintenance plan

Check Data

1. Profile of channel and ridge (only one required if in a system)
2. One cross section per reach at most restrictive station
3. Length
4. Seeding performed

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INSTRUCTIONS FOR USE OF SPECIFICATION 362

1. APPLICABILITY

Construction Specification 362 is applicable to diversion construction where the extent of earth excavation and embankment installations is considered minor.

2. ITEMS TO BE INCLUDED IN SECTION 7 AND/OR DRAWINGS

- a. Location and length of diversion(s) in plan view.
- b. Typical cross section(s) for diversion.
- c. Locations of special borrow area(s) and waste or disposal area(s), if required.
- d. Profile and/or channel grade.
- e. Provide the details for a level spreader or other outlet protection if needed.
- f. State if topsoil does not have to be stockpiled and spread over diversion.
- g. Specify any pipe or other materials that are needed.
- h. Temporary and permanent vegetative and/or lining or mulching requirements.
- i. Reference to other practice specifications (e.g. 412, 468, 620), if applicable.